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Interactive Comment

Interactive comment on "Changes in C_3/C_4 vegetation in the continental interior of the Central Himalayas associated with monsoonal paleoclimatic changes during the last 600 kyr" *by* M. Mampuku et al.

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Authors applied δ13C analysis to lake sediments in the Kathmandu valley at the south slope of the Central Himalayas, where warm temperate forests with subtropical tree species are components of the ecosystem, to reconstruct local vegetation history for the last 600 kyrs. South slope of the Central Himalayas is directly influenced by the Indian monsoon system and thus, a long and continuous record of the vegetation history will provide valuable information to examine the past Indian monsoon variability especially on glacial-interglacial scales. Authors observed that variations of total organic

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Interactive Discussion

Discussion Paper

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carbon (TOC) of 180-m-thick lake sediments are positively correlated with variations of C/N ratio. Since land plants commonly contain high and algae contain low C/N ratios, the C/N ratio was used as a proxy to indicate the relative abundant of soil organic carbon derived from land plants. Authors also observed high TOC-C/N zones have δ13C values averaging -27 permil and low TOC-C/N zones have δ13C values averaging -22 permil, and suggested that densely vegetated C_3 floras and somewhat sparsely covered, mixed C_3/C_4 floras provided the organic input for the high and low TOC-C/N zones in the lake sediments. This finding is further supported by a positive correlation between δ13C values and the percentage of non-arboreal pollen (%NAP), because high %NAP values indicate more open grassy habitat and low %NAP values reflect more closed forest ecosystem. On the basis that C_4 photosynthesis has higher water use efficiency than C_3 photosynthesis, authors interpreted that flourished C_3 floras, likely warm-temperate broad-leaf deciduous forest with subtropical tree species, occurred during wet interglacial intervals and mixed C_3/C_4 woody grassland occurred during dry glacial intervals. Consequently, authors attributed the C_4 plant expansion to the weak Indian monsoon induced dryness during glacial periods at the southern slope of the Central Himalayas. Finally authors wiggle-matched the δ13C zones to 6 glacial-interglacial cycles recorded in the marine δ18O record. This research reported important ecosystem information, controlled by Indian monsoon intensity over the last 6 glacial-interglacial intervals and therefore has a broad significance to the paleoclimate and carbon isotope geochemistry communities. The analytical results show evidence that the aridity caused by weak Indian monsoon and strong NE continental dry winds during glacial periods was the reason for C_4 plant expansion, and intensified Indian monsoon rainfall during interglacial periods supports a healthy C_3 habitat. It is also important to report the oscillation record of woody-grassland and monsoonal forest at the south slope of the Central Himalayas for the last 6 glacial-interglacial cycles.

Discussion 1. We appreciate that authors can move forward to characterize weak monsoon induced aridity and discuss the role of seasonal droughts on C_4 plant expansion during peak glaciations. For instance, the timing of termination of moisture-laden

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Indian monsoon could be important information because early onset of NE dry continental winds results in prolonged seasonal droughts. If retreat of Indian monsoon and onset of dry continental airmass occurred in the middle of summers during the peak glaciation rather in late falls as in present condition, dry summer conditions could facilitate C_4 photosynthetic pathway. If intensified NE dry winds provide no precipitation at all during dry seasons, many C_3 trees could not survive the prolonged seasonal drought, which give rise to grass expansion. In our 1998 paper (Geology, 26, 987-990), we described that we did not fully understand some patterns of δ13C values obtained from southern Chinese Loess Plateau, and we interpreted one pattern as to show early termination of wet monsoon season in middle summers during parts of the last glaciation probably caused C_4 plant expansion. Because occasionally when Indian monsoon is still active in October, the earliest Siberia-Mongolia dry winter winds could advance into western China, the Indian monsoon airmass over Himalayas could override the low-level Siberia-Mongolia airmass causing a cool moist late fall. This event made it complicated to discuss the monsoonal droughts and C_4 plant expansion. We hope the δ13C record obtained from the south slope of the Central Himalayas should provide better information for understanding the monsoonal droughts and C_4 plant expansion. 2. To correlate basal Zone 1 and Zones 2, 3, and 4 in RB core to MIS 5 appears not consistent with authors' argument. I understand that authors intended to make a perfect match between δ13C excursions and MIS 5a, b, c, d, and e substages. But it is not self-justified. It is nothing wrong to correlate the low valued δ13C excursions in Zones 2 and 4 to MIS 5a-c (or in part) and MIS 5e, which can be explained by sedimentary hiatus, slow sedimentation rate, or probably only 2 rather than 3 warm phases in the terrestrial last interglacial in this region. Actually, our recent study of a long loess-paleosol succession in non-glaciated southern Illinois, USA, found 2 separated Bt horizons in the Sangamon Geosol unit that is equivalent to the MIS 5 (in review). It could be an important finding to show that the terrestrial last interglacial at the south slope of the Central Himalayas contains 2 equally warm rather than 1 strong and 2 weak warm phases as the marine record of MIS 5 indicates. 3. The results of nalkanes analysis seem not to support author's arguments. Authors don't have to keep this line of analysis in this paper and consider saving the data for a separate paper with more indicative information in the future.

Authors need to explain the description of "the 218-m-long core obtained" on p874 and "the 180-m-long core" for the research on p876. On p873, line 4 from the bottom, "(Manabe, 1974Ě)" should be "(Manabe and Terpstra, 1974Ě)". On p886, line 5 from bottom, "1985" should be "1995".

Interactive comment on Clim. Past Discuss., 3, 871, 2007.

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